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PROSTATE-SPECIFIC ANTIGEN TESTING IN BLACK AND WHITE MEN: AN ANALYSIS OF MEDICARE CLAIMS FROM 1991–1998

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ABSTRACT

Objectives. To describe the trends in prostate-specific antigen (PSA) use and associated cancer detection among black and white Medicare beneficiaries older than 65 years during the calendar period from January 1991 through December 1998.

Methods. Medicare claims data were linked with cancer registry data from the Surveillance, Epidemiology and End Results program of the National Cancer Institute. Data from a 5% random sample of men without a diagnosis of prostate cancer were combined with data from prostate cancer cases diagnosed during the calendar period from 1991 to 1998. PSA tests conducted after a diagnosis of prostate cancer were excluded.

Results. PSA use has stabilized among white men, reaching an annual rate of 38% by 1995 and remaining at this level through 1998. The annual rate of use among black men reached 31% by 1998, but was still increasing at that time. By 1996, at least 80% of tests in both blacks and whites were second or later tests. By the end of 1996, 35% of white men and 25% of black men were undergoing testing at least biannually or more frequently. In 1996, 83% of diagnoses in whites and 77% in blacks were preceded by a PSA test.

Conclusions. Older black men lag slightly behind older white men in their use of the PSA test; however, annual testing rates in blacks have yet to stabilize. In both race groups, an overwhelming majority of diagnoses are associated with a PSA test, whether for screening or diagnostic purposes. Regular screening rates in blacks are substantially lower than in whites, but the regular screening rates are relatively low in both race groups. Should PSA screening prove efficacious, efforts to promote regular use among both black and white men will likely be needed.

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Since its introduction, PSA testing has rapidly disseminated in the U.S. population.[1] Although originally approved for monitoring disease progression after the diagnosis of prostate cancer, the test was quickly adopted for screening purposes. By the end of 1994, approximately 53% of whites and 45% of blacks aged 65 and older in 1988 had had a test.[1]

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Racial disparities in the incidence of, and mortality from, prostate cancer, are well-known.[2,3] Black men are more likely to be diagnosed with the disease and to die of it. A number of surveys have indicated that black men are also less likely to undergo PSA screening.[4,5] Barriers to screening among black men have been explored.[6,7]

The limitations of survey data concerning prostate cancer screening histories have recently been investigated.[8] The study showed that patients' self-reports of PSA use were discordant with their medical record 29% of the time, with patients tending to over-report recent use of the test. The primary reasons advanced for these findings were recall bias due to memory "telescoping" and lack of knowledge.

This study compared the use of PSA testing in blacks and whites using a population-based, administrative database, which consists of a linkage between the Surveillance, Epidemiology and End

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Results (SEER) Program of the National Cancer Institute,[9] and Medicare claims files from the Health Care Financing Administration.[10] By direct use of claims data, our goal was to avoid the aforementioned biases that can potentially accompany patient surveys.

MATERIAL AND METHODS

SEER–Medicare Database

The SEER cancer registry collects information on cancer incidence and survival in 13 geographic areas in the United States, covering approximately 14% of the U.S. population.[9] The Medicare claims data include both inpatient and outpatient procedures, as well as physician services. We used data on individuals aged 65 years and older between 1991 and 1998 inclusive who were entitled to Medicare parts A and B at some time during this calendar period. Health Maintenance Organization enrollees were excluded.

The linked SEER–Medicare data cover the period from 1991 to 1998. Medicare claims data were available for all SEER cases diagnosed through 1996, as well as for a random 5% of controls without cancer (non-SEER cases) residing in the SEER registry locations. The HCPCS (CPT-4) codes provided with the Medicare claims data were used to identify PSA tests (CPT codes 86316 and 84153), needle biopsy (CPT codes 55700-55705), ultrasonography (CPT codes 76942-76943) and transrectal ultrasonography (CPT codes 76872 and 76991). Because of the SEER–Medicare linkage, we were able distinguish prediagnostic from postdiagnostic PSA tests through 1996.

Statistical Analysis

Annual Testing Rates. To estimate the annual testing rates, we weighted controls by a factor of 20 to account for the relative fractions of prostate cancer cases and controls in the data. The denominators for the testing rates consisted of all men alive and without prostate cancer at the start of the year. The numerators consisted of all men with at least one PSA test conducted during the year.

To avoid counting follow-up tests conducted in response to a suspicious result, we classified tests as either initiating or follow-up tests. We defined an initiating test as either a first occurrence of a test in the database or a test conducted at least 3 months after a preceding test. A follow-up test was defined as a test conducted within 3 months of an initiating test. We defined a single testing episode as consisting of an initiating test and all associated follow-up tests. To evaluate the sensitivity of results to the choice of interval used to define a testing episode, analyses were also conducted based on a 6-month definition.

Cancer Detection Rates. Because the test results were not available, we defined PSA-detected cases as those cases diagnosed within 3 months of a PSA test. Life table methods were used to account for a loss to follow-up during the 3 months after a test with censoring owing to death, the end of the surveillance period, or repeated PSA testing within 3 months.

Relative Frequency of First Versus Second or Later Tests. The relative frequency of first versus second or later initiating tests was of interest because this allowed us to estimate the proportion of men adopting the technology versus returning for serial screening. However, it was not possible to identify which tests were first tests because our follow-up period began in 1991 (or later, for men turning 65 thereafter). To estimate the relative frequency of first tests, we used the observation[1,11] that the cancer detection rate for the first tests would be significantly greater than for later tests. Thus, let p be the proportion of first tests among all tests performed during the year. Then, CDR, the cancer detection rate observed in a given year is equal to $pCDR_1 + (1 - p)CDR_2$, where CDR_1 and CDR_2 are the cancer detection rates for the first and subsequent tests, respectively. The CDR is available from our data for calendar years 1991 through 1996. We used CDR_1 values from Legler *et al.*[1] and CDR_2 values based on the second or later tests in our data.

Patterns of Care After a Test. To summarize the patterns of care after a PSA test, we estimated the cumulative incidence[12] of prostate ultrasonography, biopsy, and repeated PSA testing within 90 days after a test. The cumulative incidence is preferable to the Kaplan-Meier estimator[13] in the presence of competing risks (ie, other events that may prevent the event of interest but are not independent of this event). We were interested in the first follow-up procedure conducted after a test. For any given follow-up procedure, all other candidate procedures constituted competing risks. In the case of prostate biopsy, for example, repeated PSA testing, ultrasonography, and death were competing risks.

Frequency of Regular Screening. Thus far, we have addressed patterns of PSA use from a cross-sectional point of view. However, the data also provided longitudinal information on testing histories that can be used to estimate the frequency of regular screening. We first estimated the frequency of regular screening among men alive and without a prior prostate cancer diagnosis in December 1996. We then examined the screening histories before this time. We considered several definitions of regular screening, including annual and biannual screening.

To qualify as receiving "strictly annual" screening, an individual had to have received at least one PSA test in 1994, 1995, and 1996. For "almost annual" screening, an individual had to have been tested in at least 2 of the past 3 years. For "strictly biannual" screening, an individual had to have received at least one PSA test in both 1994 and 1996 or in both 1993 and 1995. We also considered a "modified biannual screening" definition, which defined regular screening as a test in either the current year or the prior year, and a test in at least 1 of the 2 years before that. In all these analyses, we used the testing episode definition. The analyses were repeated for men alive at the end of 1993 (annual analysis only), 1994, and 1995. This allowed us to evaluate whether the frequency of regular screening was changing over time.

RESULTS

Annual Testing Rates

Figure 1 displays the overall PSA testing frequencies by age group, race, and calendar year. Figures 1A and B show the testing rates by 5-year age groups. By 1998, the annual testing rates were approximately 20% higher for whites than for blacks, with the exception of men older than 80 years, for whom the testing rates appeared to be comparable across race groups. Figures 1C and D put these results in historical perspective, showing data for all age groups combined together with the results from Legler *et al.*[1]

Cancer Detection Rates

The cancer detection rates declined with time, but the decline after 1991 was far less extreme than that observed during the initial few years of PSA dissemination[1] (Table I). Between 1991 and 1996, the cancer detection rates declined from 4.5% for

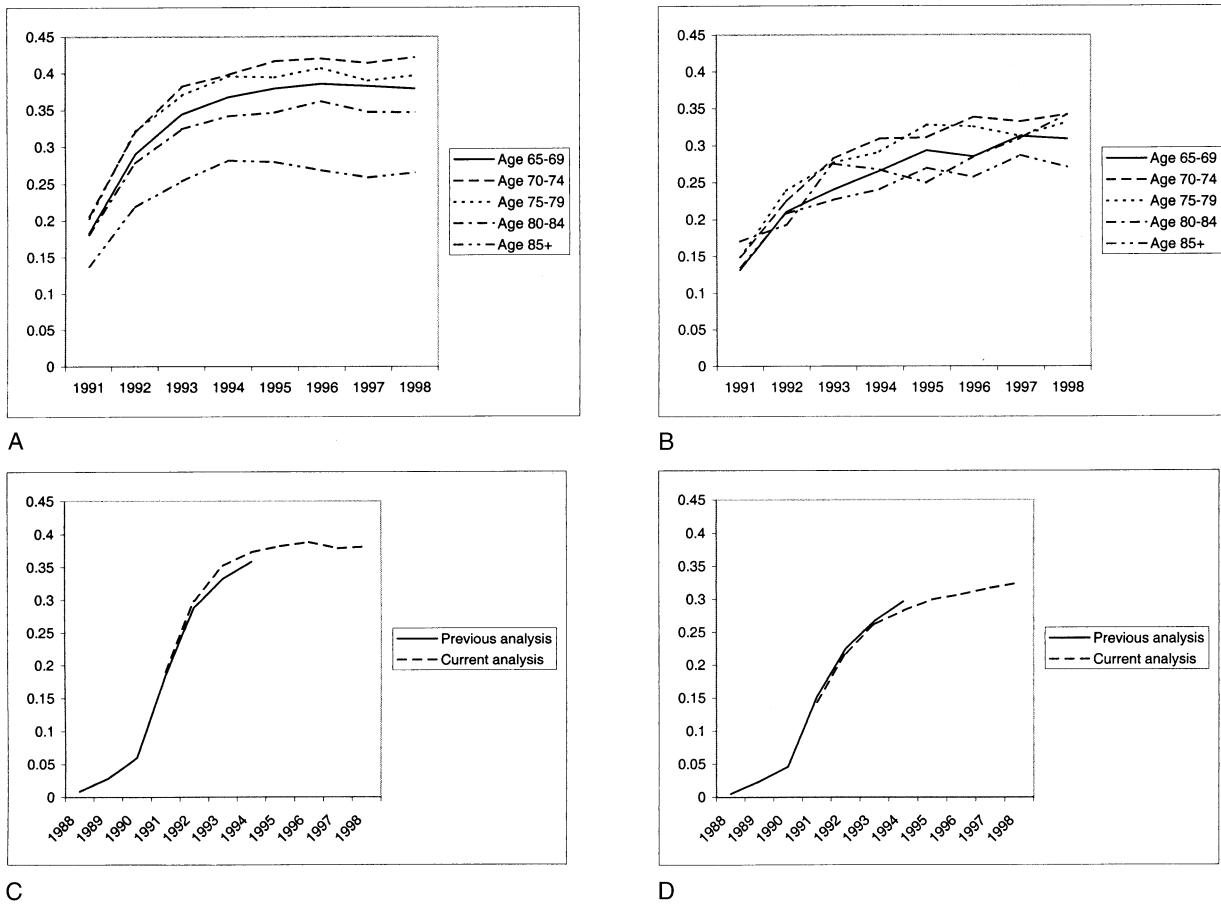

FIGURE 1. *Overall PSA testing frequencies by age, race, and calendar year, showing the number of men with at least one PSA test during a given year, divided by the number of men alive and without a prior prostate cancer diagnosis at the start of the year. (A) Whites 1991 to 1998. (B) Blacks 1991 to 1998. (C,D) All age groups combined, together with comparable results from Legler* et al.[1] *through 1994 (previous analysis is analysis of Legler* et al.[1]*).*

TABLE I. ***Estimates of overall CDRs, CDRs associated with first testing episodes,* and CDRs associated with second or later testing episodes***

	Whites				Blacks			
Year	CDR	CDR_1 †	CDR_2	*P*‡	CDR	CDR_1 †	CDR_2	*P*‡
1991	0.045	0.065	0.018	0.576	0.062	0.064	0.026	0.955
1992	0.030	0.045	0.013	0.542	0.054	0.084	0.023	0.508
1993	0.020	0.040	0.010	0.337	0.038	0.082	0.018	0.315
1994	0.015	0.040	0.009	0.194	0.027	0.082	0.013	0.206
1995	0.012	0.040	0.008	0.126	0.024	0.082	0.013	0.152
1996	0.006	0.040	0.003	0.074	0.013	0.082	0.007	0.089

KEY: *CDR = cancer detection rate; CDR_1 = CDR associated with first testing; CDR_2 = CDR associated with second or later testing.*
A 3-month testing episode definition is used.
* *Data from Legler* et al.[1]
† *Values after 1993 set equal to 1993 values.*
‡ *Frequency of first relative to second or later testing episodes by race and calendar year.*

whites to approximately 1%, and from 6.2% for blacks to approximately 2%.

Relative Frequency of First Tests

Table I shows that by 1996, the vast majority of testing episodes in both blacks and whites were second or later episodes. The estimates for the 6-month testing episode definition were similar but higher; 10% and 13% of testing episodes in 1996 were first episodes for blacks and whites, respectively. We also computed empirical estimates of the relative frequency of first versus second or

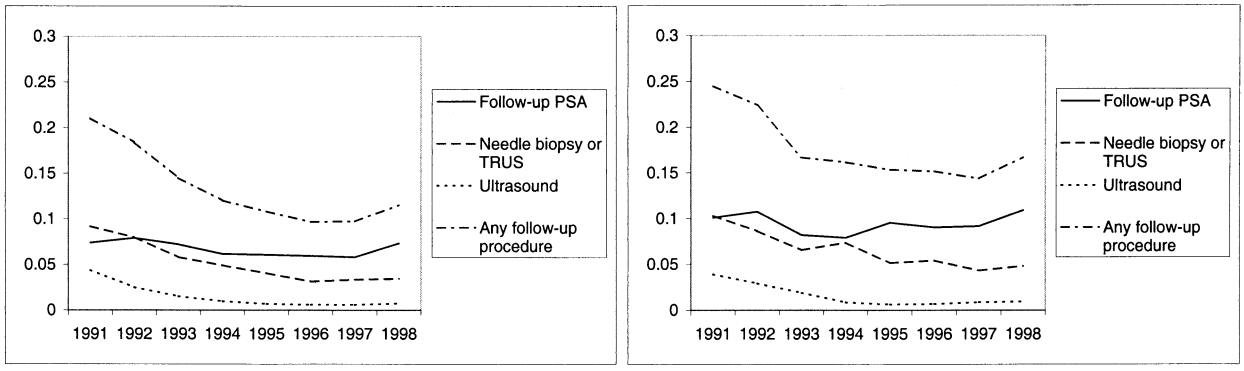

FIGURE 2. *Patterns of care after a test by race and calendar year. Cumulative incidence of specific follow-up procedures within 90 days of an initiating PSA test (3-month definition). For a given procedure, death due to other causes, prostate cancer diagnosis, and performance of alternative follow-up procedures acted as competing risks. (A) Whites. (B) Blacks.*

later tests for the years 1994 through 1996. Because this calculation was based on testing histories that go back only as far as 1991, the results represent upper bounds on the relative frequency of first tests. Among whites, the upper bound was 22.4%, 14.4%, and 10.7% for the years 1994, 1995, and 1996, respectively; for blacks, the corresponding figures were 28.8%, 21.2%, and 17.5%.

Patterns of Care After a Test

Figure 2 shows the frequency of various follow-up procedures conducted within 90 days of a PSA test by race and calendar year. Among the follow-up procedures conducted, the frequency of follow-up PSA testing appeared to increase with time relative to prostate biopsy. This result appeared to hold for both blacks and whites and suggests that either the frequency of an abnormally high PSA value is declining or the response to an abnormal result may be tending toward less invasive follow-up.

Frequency of Regular Testing

Among men alive at the end of 1996, approximately 35% of whites and 25% of blacks were following strict biannual testing, up from 25% and 18% in 1994. For annual testing the results were 17% and 10% in 1996 versus 8% and 5% in 1994 for whites and blacks, respectively. For the more relaxed definitions, the rates of use were slightly higher than the corresponding "strict" definitions. Many of the men tested in 1996 had had a prior test but did not qualify as being on a biannual or more frequent screening schedule.

COMMENT

This analysis of PSA testing among Medicare recipients provides a comprehensive picture of the use of the test among elderly black and white men in the United States through 1998. Annual testing frequencies have reached a steady state among whites and are leveling off among blacks. Approximately one third of whites and one fourth of blacks at risk of a prostate cancer diagnosis appear to be following a regular screening regimen. The trends in patterns of use among whites are similar to those among blacks, although the diffusion of the technology among blacks has been lower and slower, with the annual frequency of use by 1998 about 15% to 20% lower than in whites.

Our results are consistent with prior surveys of screening behavior in black and white men[4–6] in that they indicate that black men are less likely to use the PSA test. However, the actual testing rates estimated from the SEER–Medicare data indicate that the discrepancies in frequency of use between the two racial groups are lower than might be expected given the survey results. We found that, by 1998, approximately 38% of whites and 31% of blacks were being tested at least once a year, corresponding to an odds ratio of 73% for testing in blacks versus testing in whites. In contrast, a recent analysis of responses to the New York Behavioral Risk Factor Surveillance System (BRFSS) in 1994 and 1995 estimated an odds ratio of 30% for testing in blacks versus testing in whites.[5] One possible reason for this difference, in addition to our data source being an administrative claims database rather than a survey, is that our results indicate trends across all SEER areas combined, rather than within a single area.

The amount of heterogeneity across the SEER areas in the dissemination of PSA testing is substantial. This was noted by Legler *et al.*,[1] who showed a correspondence between prostate cancer incidence patterns and rates of first-time PSA test-

ing in two SEER areas with quite different PSA use trends. We repeated our key analyses by SEER area and found striking differences in testing patterns. For instance, annual PSA testing rates among whites were almost uniformly highest in Atlanta, Detroit, and Los Angeles and lowest in Connecticut, Utah, and Iowa, with up to a 50% discrepancy between the highest and lowest rates in some years. Virtually all areas showed increasing rates of use with time, with the exception of Seattle, where use was virtually flat, following earlier, rapid adoption of the test.[1]

A major limitation of the use of claims data to analyze testing patterns is the lack of information on the reasons for conducting the test. Although most SEER cases in our database had had a PSA test within 3 months before diagnosis, it is not clear how many tests were true screening tests conducted in asymptomatic individuals. This problem severely complicates attempts to draw inferences about the effects of PSA screening on the outcomes of interest like disease mortality. The vital importance of this information argues for the expansion of surveillance systems to include it at the time of diagnosis.

Our estimates of the frequency of regular screening are relatively high for a screening technology that has not been proved to save lives and that has been associated with significant treatment morbidity. However, the implication is that more than 60% of white men and 70% of black men alive and at risk of a prostate cancer diagnosis are not being tested regularly or at least biannually. Should regular PSA screening prove to be efficacious in the randomized studies that are under way,[14,15] its regular use among older men will need to be promoted.

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